

REMARKS

Claims 1, 3-12, and 19-21 are active in the present application.

Applicants wish to thank Examiner Kornakov for the helpful discussion with the Applicants' undersigned representative on November 13, 2002. Applicants would also like to thank the Examiner for the indication that the rejections under 35 U.S.C. §112, second paragraph, and of Claims 1, 4 and 6 under 35 U.S.C. §102 over EP 0 081 355, as well as the objection under 37 C.F.R. §1.75(c), have been withdrawn (paper number 8, page 2, numbered paragraphs 1, 2, and 11).

In semiconductor processing (i.e., manufacturing), etching is commonly controlled using a CF-based process gas (pages 1-2). In these methods, etching anisotropy and etching rate, as well as the chemical and physical actions given to the silicon oxide film from the active species and ions from the plasma, are controlled using the CF-based deposit produced from the decomposed substances of the process gas (page 2, lines 11-21). During these methods, CF-based byproducts accumulate on the process chamber and processing apparatus, which eventually peels off upon reaching a certain thickness, thus forming particles (page 2, line 22 to page 3, line 9). The production of particles arising from CF-based byproducts ultimately leads to a decreased yield of semiconductor devices, and as such removal of the byproduct deposits must be undertaken to enhance yields (page 3, lines 9-11).

The present Inventors have solved this critical need for improved cleaning methods by providing a cleaning solution for removing a byproduct derived from a decomposed substance of a process gas containing C and F, and deposited on a component in a process chamber of a semiconductor processing apparatus for subjecting a target substrate to a semiconductor process with the process gas, where the cleaning solution contains N-methyl-2-pyrrolidone, ethylene glycol monobutyl ether, a surfactant, and water (see Claims 1 and 7).

The rejection of Claims 1, 4, 13, 14, 15, 18, and 19 under 35 U.S.C. §102 over Han et al is obviated in part by amendment and traversed in part. Claims 13, 14, 15, 18, and 19 have been canceled without prejudice toward prosecution in an ensuing continuation application.

Han et al disclose a composition having:

- a. from about 1 to 40%, and preferably 4 to 20%, of a surfactant selected from the group consisting of anionic surfactants, nonionic surfactants and mixtures thereof;
- b. up to about 10% of a builder selected from the group consisting of polyphosphates, pyrophosphates, citrates, and carbonates;
- c. up to about 2% of an amine selected from the group consisting of monoethanolamine, diethanolamine and triethanolamine;
- d. water; and
- e. further comprising from about 3 to 50% of a solvent, which solvent is selected from the groups consisting of:
 - i) sulfolane, propylene glycol monomethyl ether acetate, dipropylene glycol monomethyl ether acetate, ethylene glycol monoethyl ether acetate, diethylene glycol monoethyl ether acetate, diethylene glycol dimethyl ether, ethylene glycol dimethyl ether, diethylene glycol diethyl ether, and mixtures thereof;
 - ii) diethylene glycol monobutyl ether, ethylene glycol monobutyl ether, and N-methyl 2-pyrrolidone; and
 - iii) a mixture of two solvents, the first such solvent comprising 5-17% of an acetate selected from the group consisting of ethyl acetate and n-propyl acetate, and the second such solvent comprising 15-34% of a solvent selected from the group consisting of acetone, N-methyl 2-pyrrolidone and methyl ethyl ketone, wherein the ratio of the first solvent to the second solvent may range from 1:4 to 1:2. (see Abstract)

Applicants note that in the description of component (e), Han et al state that the formulation “further comprises from about 3 to 50% of *a solvent*, which solvent is selected from the groups consisting of i), ii), and iii)” (column 2, line 8-9). Therefore, although Han et al provide for the possibility that N-methyl-2-pyrrolidone and ethylene glycol monobutyl ether may be used in the same solvent system, Han et al fail to provide adequate motivation

to select these two specific compounds from the extensive list of thousands of alternative solvents and solvent mixtures (see Abstract and Claim 1).

Moreover, it appears that the full disclosure of Han et al intends for ethylene glycol monobutyl ether and N-methyl 2-pyrrolidone to be alternatives only, and not desired to be present in the composition at the same time. Support for this interpretation of Han et al can be found at column 9, lines 67-68, which states “3% to 20% solvent, which can be Butyl Cellosolve, Butyl Carbitol, *or* N-methyl 2-pyrrolidone.” Moreover, Han et al do not provide any example in which both solvents are present; in fact, Example D (column 10, lines 24-40) puts forth 6 compositions, which contain either ethylene glycol monobutyl ether *or* N-methyl 2-pyrrolidone. Accordingly, there would be no motivation based on the disclosure of Han et al to make a composition containing *both* ethylene glycol monobutyl ether and N-methyl 2-pyrrolidone.

Therefore, it cannot be reasonably maintained that Han et al provide sufficient motivation to select *both* ethylene glycol monobutyl ether and N-methyl 2-pyrrolidone from the extensive list of thousands of alternative solvents and solvent mixtures provided by the disclosure that the solvent is selected from the groups consisting of i), ii), and iii (see Abstract and Claim 1), much less realize the attendant advantages associated therewith.

To demonstrate the advantages associated with the presently claimed invention, Applicants submit herewith an executed Declaration under 37 C.F.R. §1.132 demonstrating that the claimed composition in which *both* ethylene glycol monobutyl ether and N-methyl 2-pyrrolidone are present is superior with respect to solubility of a urethane coating as compared to either component alone. For the Examiner’s convenience, Applicants provide the following tables to summarize the results of the Declaration under 37 C.F.R. §1.132.

Cleaning Solution	NMP	EGME
S1	Yes	No
S2	No	Yes
S3	Yes	Yes

*NMP = N-methyl 2-pyrrolidone

EGME = ethylene glycol monobutyl ether

Cleaning Solution	S1	S2	S3
Time (min)	Dissolved Amount (g)	Dissolved Amount (g)	Dissolved Amount (g)
10	4.2	2.0	10.5
20	9.6	3.5	21.0
30	13.6	6.3	32.0
40	18.0	7.8	42.3
50	23.6	9.5	55.2
60	28.3	11.6	61.2
70	33.9	13.0	69.8
80	37.6	14.6	78.3

The data present above were acquired by immersing a test piece that had been inactivated with a 100g-urethane coating in one of the above cleaning solutions. At the defined times the solubility of the urethane coating on the test pieces was determined. As is clearly evident from these results, the solubility in the inventive cleaning solution (S3) was more than two times that in cleaning solution S1 and more than five times that in cleaning solution S2. Applicants submit that these advantages are neither disclosed nor suggested by the disclosure of Han et al. In view of this failure, coupled with the absence of sufficient motivation to select a composition that contains *both* ethylene glycol monobutyl ether and N-methyl 2-pyrrolidone, Applicants submit that Han et al fails to anticipate and/or render obvious the present invention.

In addition, Applicants note that the standard for determining anticipation requires that the reference “must teach every element of the claim” (MPEP §2131). Therefore, the absence of a disclosure or suggestion that the cleaning solution is for removing a byproduct derived from a decomposed substance of a process gas containing C and F, and deposited on a component in a process chamber of a semiconductor processing apparatus for subjecting a target substrate to a semiconductor process with the process gas as presently claimed, Han et al do not anticipate the presently claimed invention.

The rejection of Claims 5 and 16 under 35 U.S.C. §103 over Han et al in view of Griesshammer is obviated in part by amendment and traversed in part. Claim 16 has been canceled without prejudice toward prosecution in an ensuing continuation application.

Han et al is discussed at length above, as are the deficiencies of this disclosure.

Griesshammer discloses a process for cleaning polished semi-conductor discs by immersing the disc in a surfactant solution followed by rinsing with high purity water (column 2, lines 15-27). Griesshammer further discloses that the disc is rendered hydrophobic by treatment with an aqueous solution of a cationic surfactant (column 2, lines 28-38). As acknowledged by the Examiner, Griesshammer “does not disclose all the specificities of cleaning composition wherein the surfactant is presented along, such solvents as ethylene glycol monobutyl ether and N-methyl-2-pyrrolidone” (paper number 8, page 6, lines 15-18). Moreover, Griesshammer fails to disclose or suggest that the cleaning solution is for removing a byproduct derived from a decomposed substance of a process gas containing C and F, and deposited on a component in a process chamber of a semiconductor processing apparatus for subjecting a target substrate to a semiconductor process with the process gas as presently claimed.

Accordingly, the disclosure of Griesshammer does not compensate for the fundamental deficiencies in the disclosure of Han et al (see above). As such, the present invention is not obvious in view of the combined disclosures of Griesshammer and Han et al.

Applicants request withdrawal of this ground of rejection.

The rejection of Claims 7-11, 20, and 21 under 35 U.S.C. §103 over Griesshammer in view of Han et al is obviated in part by amendment and traversed in part.

As stated above, Griesshammer discloses a method for cleaning semiconductor discs in which the discs are first polished and then immersed in a surfactant cleaning solution (see Claim 1). As acknowledged by the Examiner, Griesshammer “does not disclose [the] all the specificities of cleaning composition wherein the surfactant is presented along such solvents as ethylene glycol monobutyl ether and N-methyl-2-pyrrolidone” (paper number 8, page 6, lines 15-18). The Examiner relies on the disclosure of Han et al to compensate for the glaring deficiencies in the disclosure of Griesshammer; however, for the reasons set forth above, Han et al fail to provide sufficient motivation to select a cleaning composition containing both ethylene glycol monobutyl ether and N-methyl-2-pyrrolidone, much less the advantages obtained thereby (see Declaration under 37 C.F.R. §1.132 attached).

Accordingly, Applicants submit that the combined disclosures of Griesshammer and Han et al fail to even support a *prima facie* case of obviousness. Applicants request withdrawal of this ground of rejection.

The rejections of Claim 6 under 35 U.S.C. §103 over Han et al in view of EP 0 081 355 and of Claim 12 under 35 U.S.C. §103 over Griesshammer in view of Han et al and in further view of EP 0 081 355 are traversed.

Griesshammer and Han et al have been discussed at length above.

EP 0 081 355 discloses a method of cleaning and reclaiming printing screens using an ink cleaning composition containing N-methyl-2-pyrrolidone, an oxygenated solvent (e.g., butyl cellosolve and cyclohexanone), and a surfactant (see Abstract). EP 0 081 355 further discloses that “the NMP, oxygenated solvent and surfactant composition *must be non-aqueous*” (emphasis added, page 6, lines 23-24). The Examiner recognizes this limitation in EP 0 081 355 by stating “EP ‘355 does not disclose the presence of water in his disclosure, as per instant claims 2 and 3” (paper number 4, page 6, lines 5-6). Therefore, the disclosure by EP 0 081 355 teaches away from the claimed invention, which *requires* the presence of water (see Claims 1 and 7).

Applicants note that MPEP §2141.02 states: “A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention.” *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). Therefore, how can the Office maintain that there would be a motivation to do what the references expressly teach away from (i.e., making a cleaning solution having N-methyl-2-pyrrolidone, ethylene glycol monobutyl ether, a surfactant, and water).

As stated above, the fact that EP 0 081 355 *teaches away* from adding water to their cleaning composition by stating that the composition “*must be non-aqueous*” (page 6, lines 23-24). Therefore, there can be no motivation to combine the disclosure of EP 0 081 355 with either Griesshammer or Han et al. Accordingly, the presently claimed invention cannot be rendered obvious in view of and combination of the disclosures of EP 0 081 355, Griesshammer, and Han et al.

Withdrawal of these grounds of rejection is requested.

The rejections of Claims 13, 17, and 18 under 35 U.S.C. §102 over EP 0 081 355 and of Claim 16 under 35 U.S.C. §103 over EP 0 081 355 in view of Griesshammer are obviated by amendment.

Claims 13-18 have been canceled by the present amendment and as such, this rejection is moot. Accordingly, withdraw of these grounds of rejection, without prejudice toward prosecution of Claims 13-18 in an ensuing continuation application, is requested.

The objection of the claims under 37 C.F.R. §1.126 is traversed.

In the Office Action mailed on October 2, 2002 (paper number 8, pages 11-12, numbered paragraph 13), the Examiner has taken the position that the renumbering of claims is not appropriate and that “the marked-up version of the Amendment, paper No. 7 contains confusing claim numbering.” However, Applicants wish to draw the Examiner’s attention to numbered paragraph 1 on page 2 of paper number 4 in which the Examiner specifically objects to numbering of the claims. At this point, the Examiner specifically states: “Misnumbered claims 3-13 have been renumbered.” In fact, it is the renumbered nomenclature that the Examiner refers to in his rejections. Accordingly, Applicants have *not* renumbered the claims, since the Examiner has already done this. Instead, Applicants include the Examiner’s renumbering as part of the amendment for the Examiner’s convenience in deciphering how the claims (new and old) relate to one another and to place the claims in proper sequential order as specifically performed by the Examiner.

Withdrawal of this ground of objection is requested.

Applicants submit that the present application is in condition for allowance. Early notification to this effect is respectfully requested.

Respectfully submitted,

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IN THE CLAIMS

Cancel Claims 13-18.

Please amend the claims as follows:

1. (Twice Amended) A cleaning solution for removing a byproduct derived from a decomposed substance of a process gas containing C and F, and deposited on a component in a process chamber of a semiconductor processing apparatus for subjecting a target substrate to a semiconductor process with the process gas, the cleaning solution [composition] comprising N-methyl-2-pyrrolidone, ethylene glycol monobutyl ether, a surfactant, and water.

3. (Twice Amended) The [composition] cleaning solution according to claim 1, wherein the water concentration is 5 to 20 wt%.

4. (Thrice Amended) The [composition] cleaning solution according to claim 1, wherein the surfactant concentration is 0.1 to 1.0 wt%.

5. (Twice Amended) The [composition] cleaning solution according to claim 4, wherein the surfactant contains fluorine.

6. (Thrice Amended) The [composition] cleaning solution according to claim 1, wherein a total content of the N-methyl-2-pyrrolidone and ethylene glycol monobutyl ether is 80 to 90 wt%, and a ratio of a content of the N-methyl-2-pyrrolidone to the total content of the N-methyl-2-pyrrolidone and ethylene glycol monobutyl ether is 0.75 to 0.95.

19. (Amended) The [composition] cleaning solution according to claim 1, wherein the composition comprises 10 ppb or less of an alkali metal.